

What's the use of handwriting?

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<http://s7d9.scene7.com/is/content/NewellRubbermaid/Write%20Your%20Future/White%20Paper%20FINAL%203APR2017%20w%20logo.pdf>

Introduction

It has become commonplace to say that handwriting is in general decline. As an example, in June 2012, the UK printing and mailing company Docmail carried out a survey of 2,000 people in the UK. The results of this study are not now available on the Internet but were widely reported in the British press at the time¹. According to this survey, one in three people had not written anything by hand in the previous six months. On average they had not put pen to paper in the previous 41 days. Two thirds of people said that, if they had handwritten anything, it was only meant for their own eyes, such as scribbled notes.

In the United States, education authorities appear to have accepted this decline. "Cursive" writing – in which the pen is not raised between each character – was dropped from the Common Core Curriculum Standards, shared by all states, undoubtedly following the evidence that email and texting have more or less replaced "snail" mail, and that students tend to take notes on their laptops, rather than via handwriting. Since 2013 American children have been required to learn how to use a keyboard and write by printing. But no longer do they need to worry about the strokes and shapes involved in "joined-up" writing. The *Los Angeles Times* (4 September 2013)² hailed this as a step forward.

"States and schools shouldn't cling to cursive based on the romantic idea that it's a tradition, an art form or a basic skill whose disappearance would be a cultural tragedy. Of course, everyone needs to be able to write without computers, but longhand printing generally works fine [...] Print is clearer and easier to read than script. For many, it's easier to write and just about as fast."

Such negative views about the importance of handwriting in the modern world (or, at least, in the US, of cursive handwriting) were summed up by Trubek (2016):

"I am a college professor and a freelance writer, and the only time I pick up a pen is to sign a credit-card receipt. Let's stop brutalizing our kids with years of drills on the proper formation of a cursive capital 'S' - handwriting is a historical blip in the long history of writing technologies, and it's time to consign to the trash heap this artificial way of making letters, along with clay tablets, smoke signals, and other arcane technologies"

Why has the role of handwriting, and by extension, its teaching, become so diminished?

¹ e.g. <http://www.dailymail.co.uk/sciencetech/article-2163175/Could-forget-WRITE-The-typical-adult-scribbled-hand-weeks.html>

² <http://articles.latimes.com/2013/sep/04/opinion/la-ed-cursive-instruction-common-core-curriculum-20130904>

The decline of handwriting

In the United States, handwriting was once taught in schools as an individual lesson and children received a separate grade for this 'subject' (Blazer, 2010). Yet, over the last decade, and more recently since the adoption of the Common Core State Standards³ in 2012, the importance of handwriting in education has diminished significantly (Dinehart, 2015). In the US, schools appear to be less likely than in previous years to teach handwriting and few teachers feel well prepared to teach it by their initial and further training (Graham et al., 2008).

This position is reflected in the policies of other nations, including the United Kingdom, where handwriting has quite a low status in literacy education (Medwell & Wray, 2008). There has never been a universal handwriting font taught in UK schools, unlike in many other countries, although current practice tends to focus on joining letters rather than printing (although with much variability). The currently mandatory National Curriculum in England (DfE, 2013) treats handwriting succinctly and focuses upon the development of letter formation. The advice given for 7-year-old children states that, *"Pupils should revise and practise correct letter formation frequently. They should be taught to write with a joined style as soon as they can form letters securely with the correct orientation"*. For 11 year-olds, the requirement is that *"Pupils should continue to practise handwriting and be encouraged to increase the speed of it, so that problems with forming letters do not get in the way of their writing down what they want to say"*. The Curriculum requirements do mention the need for increasing fluency in handwriting but, given the high emphasis in these requirements upon ways of joining letters together, it seems that the definition of fluency at work here is concerned with efficient joining. For example, the requirements for Year 3 and 4 children (7 to 9 year olds) state that pupils should be taught to:

- *use the diagonal and horizontal strokes that are needed to join letters and understand which letters, when adjacent to one another, are best left unjoined*
- *increase the legibility, consistency and quality of their handwriting [for example, by ensuring that the downstrokes of letters are parallel and equidistant; that lines of writing are spaced sufficiently so that the ascenders and descenders of letters do not touch]*

There are a number of formal tests to assess pupils' progress through the National Curriculum, although none which include an assessment of handwriting. This is covered instead through on-going teacher assessment in which children have to show evidence of meeting a number of statements at age 7 and again at age 11. Some of these statements do refer to features of handwriting, although this is somewhat undone by the general caveat that: *"Where pupils are physically able to write and meet all of the statements except for being able to produce legible handwriting, they may be awarded the 'expected standard' but cannot be awarded the 'greater depth' standard"* (Standards and Testing Agency, 2016).

This summary of the place of handwriting in UK mainstream primary schools underlines the minimal attention given to handwriting in the writing process in most English-speaking countries⁴. One reason for such a lack of attention has been the perspectives on writing that have been popular in schools and the emphasis (or lack of emphasis) these perspectives have placed upon handwriting.

³ <http://www.corestandards.org/>

⁴ This is not the case in non-English speaking countries. In countries such as France, a great deal of attention is given in teaching to fluent cursive writing. A useful summary of the relations between handwriting and culture can be found on the European Mama site - <http://www.europeanmama.com/handwriting-around-the-world/>

In early years' education, evidence that children can write meaningful texts before they have mastered the writing system (Teale & Sulzby, 1986) changed the way researchers and teachers looked at children's early attempts at writing (Temple et al, 1982). Analysis of children's early writing for evidence of understandings about the language system (Clay, 1975), spelling (Gentry, 1981) and audience (Hall, 1987) shifted attention away from the teaching of writing through copying, with its emphasis on correct letter formation and legibility. Emergent writing (Hall, 1987; Teale & Sulzby, 1986), placed the focus of attention firmly on the meanings children were able to create in their writing. Children were encouraged to write freely and to use their emerging, but incomplete, understandings of language and writing skills to express themselves in writing. This was a corrective to earlier emphasis on neatness and correct letter formation, which undoubtedly hindered the composition of beginning writers.

The teaching of writing to older children has also been strongly influenced by theoretical perspectives that emphasise the difference between composing text and transcribing text. Graves' (1983) account of the writing process as a series of stages was highly significant for theorised pedagogies of writing. More recently, a genre focused approach to writing, emphasising the direct teaching of the structures of socially significant texts, was popularized by the work of Wray and Lewis (1997) and included in the requirements of the UK National Literacy Strategy (1998). In none of these perspectives on writing and its teaching did handwriting play a significant role.

The place of handwriting has also been highly affected by the ubiquity of computers and various other screen-based writing media. A good deal of media attention in the UK was given to the decision of Finland to abandon the requirement for children to master traditional cursive handwriting. Instead, the emphasis would be on the teaching of touch typing and the most efficient way to compose a text message⁵. To many, the ubiquity of computer and smartphone text entry seemed an inevitable pressure pushing us away from writing by hand.

In the Washington Post in 2013⁶, even Steve Graham, whose research we will review later as we examine the argument that handwriting is linked to composition, was quoted as suggesting that handwriting, particularly cursive writing, was under some threat:

*"The truth is that cursive writing is pretty much gone, except in the adult world for people in their 60s and 70s."
He said that today's teachers value typing more than handwriting, and that by the 12th grade, about half of all papers are composed with computer word processing.
"When you think about the world in the 1950s, everything was by hand. Paper and pencil," Graham said. "Right now, it's a hybrid world."*

There is certainly evidence for such a shift away from handwriting. The US Postal Service⁷ reports a total mail volume of 213 billion items in 2006. By 2015 this volume had decreased to 154 billion items. In the UK, the PWC (2013) report noted a decline in mailed items from 19.7 billion items in 2005 to 13.8 billion in 2012, and projected a further decline to 8.3 billion in 2023. This report refers to similar declines in all Western countries and suggests that:

⁵ <http://www.telegraph.co.uk/news/worldnews/europe/finland/11391999/Finland-to-teach-typing-rather-than-handwriting-in-schools.html>

⁶ https://www.washingtonpost.com/local/education/cursive-handwriting-disappearing-from-public-schools/2013/04/04/215862e0-7d23-11e2-a044-676856536b40_story.html

⁷ <https://about.usps.com/who-we-are/postal-facts/decade-of-facts-and-figures.htm>

The principal cause of the overall mail volume decline has been the substitution of paper communication by electronic methods. (7)

Of course, the majority of the mail items referred to here would have been connected to various business operations and thus would have been typed rather than handwritten.

Electronic communication has certainly mushroomed in recent years and shows no sign of its increase slowing. The Radicati Group report (2016) suggests a growth from 215 billion emails sent every day in 2016 to 257 billion emails per day by 2020. Such evidence suggests that, in terms of sheer functionality in the modern world, handwriting has faced, and will continue to face, significant challenges from burgeoning electronic modes of communication.

Steve Graham, in the Washington Post piece quoted earlier, suggested that the argument for continuing to teach cursive handwriting centres on tradition rather than on practicality.

“What I typically hear for keeping cursive is how nice it is when you receive a beautifully cursive-written letter. It’s like a work of art. It’s pretty, but is that a reason for keeping something, given that we do less and less of those kinds of cards anymore?”

In the face of such decline, what are the arguments for continuing to teach handwriting in schools?

What does research tell us about the importance of handwriting?

a) Handwriting and memory/cognition

Does writing by hand help us to remember and think about ideas? Recent insights into this question have come from research at both ends of the educational spectrum: with very young children, and with college / university students. These suggest that there is something particular about handwriting which works to develop thinking / cognition, and helps to fix ideas in the learner’s mind (memory).

In a study with four- and five-year-old children, James and Engelhardt (2012) used magnetic resonance imaging technology to observe the effects on brain activation of children engaging in a variety of writing-like activities, such as writing letters by hand, tracing letters and typing letters. They found that areas of children’s brains previously associated with reading (the so-called ‘reading circuit’ (Wolf, 2007)) were activated when the children wrote letters to a much greater degree to when they engaged in other forms of sensorimotor activity, including typing of letters. The extent to which such activation influences children’s development is not clear – we are still in the early stages of an understanding of neurological influences on literacy skills. Nevertheless, a plausible conclusion might be that writing letters by hand was somehow implicated in the development of reading in young children.

It has also been shown that writing skills developed before children enter formal schooling can predict their academic achievement years later. Dinehart and Manfra (2013) examined the links between the fine motor skills of preschool children and their academic achievement two years after starting school. This study was a large one, involving over 3,000 young children, all of whom were observed undertaking a range of fine motor tasks. Some tasks involved fine motor manipulation, such as building with blocks, weaving string, lacing beads and cutting with scissors, and some fine motor writing tasks, such as copying letters, numbers and shapes, and drawing simple objects such as people and houses. The children’s effectiveness in carrying out such tasks was measured and these outcomes compared with their later achievements in school. The results suggested that all the fine

motor skills examined had some link with these achievements, but the fine motor writing skills were consistently stronger predictors of reading and mathematics achievement.

Research such as this is as yet in its infancy but these results are promising in that they confirm a need for some direct teaching of the skills of letter formation in the early years. The research is reviewed by Dinehart (2015) who makes the point that:

There is little evidence to support the notion that children will 'catch' writing skills, and the ability to produce high-quality text is only expected to develop once transcription skills are fully developed (8).

Graham (1999) has also made the point that if teachers only give specific emphasis to handwriting when children have failed to 'catch' it, then a great many poor habits may well be developed which become progressively harder for teachers to remedy.

Students experiencing later stages of education, that is, college and university, have to make choices about the way in which they record the ideas and information which they need to remember and understand. Most college students are regular users of digital technology⁸, integrating this into their studies in a number of ways, such as using their laptops to take notes in lectures. On the face of it, this seems a good idea, and is likely to produce quite a full and LEGIBLE account of the ideas conveyed in the lecture. However, in a much quoted study, Mueller and Oppenheimer (2014) found that college students who took notes on lectures using handwriting remembered more about these lectures than their colleagues who used a laptop to take notes. The notes taken by the laptop users tended to consist of verbatim quotations from the lectures, rather than reframings of the ideas they had encountered, suggesting a more surface processing of the lecture material.

The study of Mangen et al (2015) supports this, finding that college students who wrote down lists of words by hand recalled them more effectively than did students who used laptops or iPads to record the words. The researchers suggest that because the kinaesthetic demands of each of these writing modes are quite different, they involve different cognitive processes. In handwriting, the writer has to use graphomotor processes to form each letter, that is, they produce a graphic shape which is as close as possible to the standard shape of the specific letter. These graphomotor processes may lead to a richer encoding of the words, facilitating their storage in long-term, as opposed to short-term, memory, resulting in better later retrieval of these words.

Mangen and Balsvik (2016) have offered an explanation for the findings emerging from their own, and others', research which tries to build connections between cognitive psychology and neuroscience. They use as their underpinning framework the interdisciplinary paradigm of embodied cognition. This focuses upon the role of body movements and motor activity in human cognitive processing. Embodied cognition implies that human thought (cognition) is not limited to internal processes within the brain, with body and motor activity then being controlled by such mental activity. Rather, this cognitive processing is actually dependent upon the body, its postures and movements as it engages with the physical environment in which it lives. Such a perspective thus provides an explanation as to why cognitive processes such as remembering, reflecting, and reframing might be affected differently by the different motor processes involved in handwriting or typing. Put simply, when you type a word you have heard, the processes involve simply selecting symbols from an array of possible symbols (hunting for the key to press). When you handwrite, however, the mind and body have to work together to create a symbol which best represents an existing mental

⁸ College and university students born after about the mid-1980s are referred to as digital natives by Prensky (2001), meaning that they were born into and grew up in a world where computers and other digital technology were ubiquitous.

image. The engagement of brain with physical activity is here a good deal more elaborate and extensive, which may account for its longer term effects on understanding and memory. In short, handwriting is a more thoughtful activity than typing, with thought being defined in the wider sense of brain-body interaction.

b) Handwriting and composition

There has been a substantial body of cognitive psychological research on the writing process over the past 20 years which, somewhat surprisingly, has had little impact on classroom practice, despite its empirical rigour and replication, and its central concern with how children learn to write. This may be because much psychological research into children's composing processes has been experimental and non-naturalist in design, or focused on children with very specific special needs, which makes its direct application to the mainstream classroom problematic. However, it is in psychology, neuropsychology and special needs education that research into handwriting has taken place that may offer insights into the composing processes of mainstream children.

The complex nature of writing has been recognised not only in models of writing (Hayes, 1996) but also by policy makers (DfEE/QCA, 2000), teachers (Wray et al., 2002) and young writers themselves (Wray, 1993). Handwriting has been seen as part of the translation of ideas, or transcription. However, in pedagogic practice this has often meant that handwriting is seen not as a part of the composing process, but as a presentation skill. Despite this, research suggests that fast, automatic handwriting may have a significant effect on children's composing. This research suggests that for writers who do not produce letters swiftly and automatically, the actual production of written letters may interfere with their ability to compose text.

A key issue emerging from a major programme of research (e.g. Berninger *et al*, 2006; Berninger & Graham, 1998) is the recognition that handwriting is far from a purely motor act. Berninger and Graham (1998) stress that it is "language by hand" and point out that their research suggests that orthographic and memory processes (the ability to recall letter shapes) contribute more to handwriting than do motor skills (Berninger & Amtmann, 2004). Handwriting is not just about training the hand; it is about training the memory and hand to work together to generate the correct mental images and patterns of letters and translate these into motor patterns of letters - automatically and without effort! If this is the case, then handwriting is an important part of writing, and a language act, rather than just a motor act used to record writing.

Significant effort has been devoted to understanding the role of working memory in writing. This refers to the temporary storage of the information necessary for carrying out tasks. Unlike long-term memory, which can store virtually unlimited amounts of material for many years, working memory is limited in the amount of material it can hold (a few items) and in the length of time it can hold it (a few seconds). Exploring the role of working memory in writing may help us to understand the interference among memory processes that contend for the same scarce memory resources. The findings of Gathercole *et al* (2004) suggest that working memory is particularly associated with the literacy scores of younger children. In particular, if young writers have to devote large amounts of working memory to the control of lower-level processes, such as handwriting, they may have little left for higher-level processes.

Christensen (2005) points out that individuals can generally conduct only one cognitive task requiring attention at a time (Sweller, 1988; Sweller & Chandler, 1994). This means that in addition to the processes of writing such as idea generation, planning and revising, the way in which an individual manages his or her cognitive resources is also critical for successful writing (Saada-Robert, 1999). Christensen (2005) identifies two main strategies to limit the demands on working memory.

One is to sequence tasks so that only one task is undertaken at a time. This has certainly been a popular way to manage writing processes at a pedagogical level and planning, drafting, revising etc. have been sequenced as steps in the writing process in many classrooms, in an attempt to reduce their competing demands on young writers. Taking a superficially similar approach to investigating the relationship between handwriting and composing, some studies have investigated the effect of removing some of the competing demands for children's cognitive attention during writing and have produced interesting results. De La Paz and Graham (1995) found that when the children were able to dictate their texts to an adult, thus freeing them from the task of handwriting, the quality of composition improved. Other studies have also showed that the elimination of the mechanical demands of writing through dictation resulted in an increase in the amount of text generated by primary aged children (e.g., Hidi & Hidiard, 1983; McCutchen, 1996, 1988). These studies are theoretically interesting in that they remove the need to generate motor codes and operate them, thus freeing cognitive attention for composing. However, the research discussed above suggests that separating writing into component processes and executing only some at a time is unlikely to be a successful strategy which is used routinely at a cognitive level for a writer, as writing processes are recursive and closely linked. Moreover, in normal writing, it is hardly possible to isolate or defer the handwriting element of writing, since without it, nothing would actually be written!

An alternative way to manage the limited amount of working memory capacity is to make some processes, such as handwriting, automatic, in order to free up cognitive resources to deal with higher level processes. Automaticity is achieved when a process can be carried out swiftly, accurately and without the need for conscious attention (La Berge & Samuels, 1974). The development of skill in writing may require the automatization of lower-level skills so that they use less of the available working-memory resources.

Our pedagogic theory, practice and policy in handwriting is underpinned by the assumption that handwriting becomes automatic relatively early on in writers' development (Medwell and Wray, 2007). However, there is little evidence for this. Scardamalia, Bereiter and Goleman (1982) suggest that handwriting is not automatic until around age ten and that handwriting continues to demand cognitive attention throughout the primary years. However, Berninger and Graham (1998) offer very convincing evidence that, for many children, handwriting continues to be demanding well into the secondary years, and beyond.

Some research suggests that automatic letter writing is a very powerful predictor of length and quality of written composition in the primary years (Graham *et al*, 1997), in secondary school and even in the post-compulsory education years (Connelly *et al*, 2006; Jones, 2004; Peverley, 2006). However, we do not know when handwriting typically becomes automatic for children, in terms of age or of rate of letter production.

An exploration of this question underpinned the research reported by Medwell and Wray (2007, 2009, 2014). In these studies, firstly seven-year-olds, and then eleven-year-olds were tested using a relatively simple alphabet writing task first designed by Berninger, Mitokawa and Bragg (1991) which involved writing in lower-case as many letters of the alphabet in order as possible in one minute. Children who completed all 26 letters in lower case continued the task using upper-case. The writing of all the children in the sample was also assessed as part of the statutory national assessments at age 7 and 11. Assessment of composition required the writing of two pieces - a longer and a shorter piece, of two contrasting text types. The pieces were marked by teachers using task specific criteria.

The studies found for each age group a high correlation between performance on the alphabet writing task and the composition assessment. It was important to establish if there was a threshold of automatic letter production for children of each age, below which a lack of

automaticity had a particularly negative impact on composition quality. The studies did this by examining the relationship between the alphabet writing task scores and the age expected scores on the national assessments of writing. The results revealed that for a seven-year-old child achieving a score of less than 12 alphabet letters per minute on the alphabet writing task correlated highly with not achieving the expected national writing score (Medwell and Wray, 2007). For the eleven-year-olds the relevant score was 22 alphabet letters per minute (Medwell and Wray, 2009).

Medwell and Wray (2014) produced an interpolation of these threshold scores on the alphabet writing task which suggested a set of scores for children aged from 7 to 11 years old. If children were observed to score below these thresholds, Medwell and Wray suggested that their handwriting and writing capability would need to be investigated further. These threshold scores can be seen in the following table.

Child age	Alphabet letters per minute threshold scores. (If children score below these, their writing/handwriting probably needs further investigation)
7 years	12 alphabet letters written in one minute.
8 years	15 alphabet letters written in one minute.
9 years	17 alphabet letters written in one minute.
10 years	20 alphabet letters written in one minute.
11 years	22 alphabet letters written in one minute.

The alphabet writing task used in the above studies has also been employed in a range of research investigations (e.g. Jones and Christensen, 1999; Rosenblum, 2005) and forms part of the DASH test battery for handwriting performance (Barnett et al, 2007). Although children have plenty of opportunity to write all these letters in the course of their school work, they rarely write the whole alphabet from memory in sequence, so the task is not well rehearsed and demands organization and retrieval of letter forms in visual memory as well as the generation of the relevant motor patterns. This process has been termed orthographic-motor integration (Berninger, 1994) and it involves mentally coding and rehearsing visual representations of letter patterns and integrating them with motor patterns. There is a growing interest in the orthographic-motor integration of handwriting – requiring as it does the ability to call to mind and write letter shapes, groups of letters and words efficiently and effectively. The automaticity with which this happens (NB., not just the speed) is suggestive of the cognitive attention the task requires.

There is also a growing body of research, particularly from psychology and work in special education, to suggest that handwriting is critical to the generation of creative and well-structured written text and has an impact not only on fluency but also on the quality of writing (Berninger & Swanson, 1994; Graham *et al*, 1997). Lack of automaticity in orthographic-motor integration can seriously affect young children's ability to express ideas in text. (Berninger & Swanson, 1994; De La Paz & Graham, 1995; Graham, 1990). Further support for the proposition that automaticity in handwriting allow cognitive attention to be directed elsewhere comes from work in graphonomics (Tucha et al, 2008) which examines the pauses and acceleration profiles of children's writing using tablet technology.

Studies suggest that orthographic-motor integration accounts for more than 50% of the variance in written language performance in children. Christensen and Jones (2000) put this as high as 67% for the children (7-8 year olds) they studied. Puranik and Al Otaiba (2012) found that handwriting and spelling were significant contributors to written expression in kindergarten children. Yates *et al* (1994) also found that transcription skill was the best variable to differentiate good and poor writers among intellectually talented students in the primary grades. Some studies have indicated that the influence of orthographic-motor integration declines with age (Berninger & Swanson, 1994). Olive *et al* (2012) found that handwriting became more automatized in the higher grades and contributed less to cognitive effort for older children (Grade 9) than for younger children (Grade 5) in a French context. Other studies indicate that orthographic-motor integration continues to exert an influence on writing well into secondary school (e.g. Christensen & Jones, 2000) and beyond (Connelly *et al*, 2006; Jones, 2004; Peverley, 2006).

Some research does hint at the possibility that similar processes to those described above may also occur when writers use keyboards rather than handwriting implements. It seems obvious to suggest that less than fluent typists may have to devote considerable cognitive attention to hunting for the correct keys, thus distracting from the attention available to their composing. Christensen (2004) did report a significant correlation between handwriting speed and keyboarding speed in a sample of nearly 300 secondary education students. Similarly, Rogers and Case-Smith (2002) reported a significant correlation between handwriting and keyboarding in 40 participating sixth-grade students. In addition, Connelly *et al*. (2007) found a significant correlation between the handwriting and keyboarding speeds of 300 children in elementary school, but found more notably that typed essays were up to two years behind in terms of composition quality than handwritten essays.

Conclusion: Some key lessons from research into handwriting, its place and function.

The research suggests that the role of handwriting in writing has been underestimated in mainstream education. The concentration has been on the benefits to spelling and legibility of well formed, joined handwriting, and the necessity for speed and automaticity has been neglected in our handwriting pedagogy. Educators have prioritised composing processes in writing, in itself not necessarily a bad thing. But in doing so we may have neglected a skill which makes a strong contribution to the composing we so value.

Handwriting, and in particular the automaticity of letter production, appears to facilitate higher order composing processes by freeing up working memory to deal with the complex tasks of planning, organizing, revising and regulating the production of text. Research suggests that automatic letter writing is the single best predictor of length and quality of written composition in the primary years (Graham *et al*, 1997) in secondary school and even in the post-compulsory education years (Connelly *et al*, 2006; Jones, 2004; Peverley, 2006).

We know that a significant number of children experience handwriting difficulties throughout their schooling, although for most these are probably not judged as sufficiently serious to justify remedial action. More of these children are boys than girls and their handwriting difficulties are likely to impact upon their ability to compose written language. There is evidence that intervention to teach handwriting can improve not only the handwriting of these children, but also their written composition.

In a national survey, teachers in elementary schools reported using commercially available programmes to teach handwriting (Graham *et al*., 2008). Yet, teachers using these curricula were still failing to implement effective, evidence-based handwriting teaching strategies (Vander Hart *et al*., 2010). They tended not to devote an adequate amount of time to the teaching of handwriting, and their teaching tended to prioritise practice over explicit instruction. Teachers in these surveys mostly reported that they had not received sufficient

training in the area in their initial and in-service teacher training (Graham et al., 2008; Brindle et al., 2016).

The research suggests, therefore, that it is time to reconsider the attention we give to handwriting in teaching:

- ***It is not simply a motor skill but a significant element of literacy in its own right.***
- ***Fluency and automaticity in handwriting are key contributors to quality in composition.***
- ***The physical movements involved in writing by hand are part of the thinking process in writing.***
- ***Handwriting is in many ways more effective as a medium for learning than digital text entry.***
- ***Many of the research insights now available to us concerning handwriting are not widely known to teachers.***
- ***There is a consequent need for a good deal of professional development in this area, and for new resources and tools for teachers.***

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